A.D. 1857 . . . . . N° 2060.

SPECIFICATION

OF

PIERRE ALEXIS FRANCISSE BOBŒUF.

PRESERVING AND OTHERWISE TREATING ANIMAL AND VEGETABLE SUBSTANCES, &c.

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Preserving and otherwise Treating Animal and Vegetable Substances, &c.

LETTERS PATENT to Pierre Alexis Francisse Bobœuf, of Paris, in the French Empire, Chemist, for the Invention of "IMPROVEMENTS IN PRESERVING AND OTHERWISE TREATING ANIMAL AND VEGETABLE SUBSTANCES, AND IN THE PURIFICATION OF OILS EMPLOYED THEREIN, AND WHICH MAY BE USED FOR OTHER PURPOSES."

Sealed the 26th January 1858, and dated the 28th July 1857.

PROVISIONAL SPECIFICATION left by the said Pierre Alexis Francisse Bobœuf at the Office of the Commissioners of Patents, with his Petition, on the 28th July 1857.

I, PIERRE ALEXIS FRANCISSE BOBŒUF, of Paris, in the French Empire, Chemist, do hereby declare the nature of the said Invention for "IMPROVEMENTS IN PRESERVING AND OTHERWISE TREATING ANIMAL AND VEGETABLE SUBSTANCES, AND IN THE PURIFICATION OF OILS EMPLOYED THEREIN, AND WHICH MAY BE USED FOR OTHER PURPOSES," to be as follows:—

The object of my Invention is, 1st, the preservation, the concretion, the hardening, and the coloring in various shades of inert animal substances (or substances of animal origin), the embalming of bodies, the preserving of skins, and the coloring of silk, wool, leather, bone, ivory, feathers, &c.; 2nd, the destruction of insects, ants, fleas, bugs, &c., and the preservation of animal and vegetable life from insects, the curing of disease in vegetable life generated or produced by or from insects or animaculæ, such as oïdium, potato disease, &c., the preservation of substances from destructive insects, the preservation of wood and of ships, the purification of all crowded habitations and places, such as hospitals, schools, barracks, &c. I employ for the above purposes vegetable and mineral oils, oils containing saponifiable

acid, oils capable of forming soluble salts in water, and of acids derived by substitution obtained from saponifiable acids contained in essential, vegetable, or mineral oils.

And my Invention includes the purification of essential, vegetable, and mineral oils containing saponifiable oils, without distillation, by separation.

The bulk of these oils is always of less density than that of the acid oils extracted from them by saponification with caustic alkalies. It will be readily conceived then that if these oils are extracted, the essential non-saponifiable, oils freed from the heavy substances which increased their density, will acquire a degree of lightness in proportion to the weight or quantity of the oils extracted.

To obtain a good alkaline salt for the preservation of alimentary substances, I employ essential oils obtained from the distillation of some vegetable or animal substance, as before described. These essential oils are to be well stirred, when three times the weight of water to the quantity of alkali employed is added, and the whole mixed for about ten minutes. The mixture is then allowed to rest for twenty-four hours, when the lower part of the liquid which contains the salt of soda is drawn off by a pump until the liquid begins to get disturbed, the clear liquid is then put on one side, and all the disturbed part is drawn off into another receptacle, and there allowed to remain until it becomes clear. At this point the essential oils do not combine, and the supernatant parts do not hold more salt of soda.

Now, to preserve alimentary substances, a phenate of soda (phénate de soude) proceeding from some of these essential oils is employed. The meats or other alimentary substances are placed in this phenate, and there left about forty-eight hours, after which they are taken out and exposed to the air to dry; or, in order to hasten the process, a more concentrated liquid is employed. Before the substances thus preserved are eaten, they must be boiled over a slow fire for about 12 hours, to dissolve and remove the phenate of soda which has been used to preserve them.

SPECIFICATION in pursuance of the conditions of the Letters Patent, filed by the said Pierre Alexis Francisse Bobœuf in the Great Seal Patent Office on the 28th January 1858.

TO ALL TO WHOM THESE PRESENTS SHALL COME, I, Pierre Alexis Francisse Bobœuf of Paris, in the French Empire, Chemist, send greeting.

Bobœuf's Impts. in Preserving, &c. Animal and Vegetable Substances, &c.

WHEREAS Her most Excellent Majesty Queen Victoria, by Her Letters Patent, bearing date the Twenty-eighth day of July, in the year of our Lord One thousand eight hundred and fifty-seven, in the twenty-first year of Her reign, did, for Herself, Her heirs and successors, give and grant unto me, the said Pierre Alexis Francisse Bobœuf, Her special licence that I, the said Pierre Alexis Francisse Bobœuf, my executors, administrators, and assigns, or such others as I, the said Pierre Alexis Francisse Bobœuf, my executors, administrators, and assigns, should at any time agree with, and no others, from time to time and at all times thereafter during the term therein expressed, should and lawfully might make, use, exercise, and vend, within the United Kingdom of Great Britain and Ireland, the Channel Islands, and Isle of Man, an Invention for "IMPROVEMENTS IN PRESERVING AND OTHERWISE TREATING ANIMAL AND VEGETABLE SUBSTANCES, AND IN THE PURIFICATION OF OILS EMPLOYED THEREIN, AND WHICH MAY BE USED FOR OTHER PURPOSES," upon the condition (amongst others) that I, the said Pierre Alexis Francisse Bobœuf, my executors or administrators, by an instrument in writing under my, or their, or one of their hands and seals, should particularly describe and ascertain the nature of the said Invention, and in what manner the same was to be performed, and cause the same to be filed in the Great Seal Patent Office within six calendar months next and immediately after the date of the said Letters Patent.

NOW KNOW YE, that I, the said Pierre Alexis Francisse Bobœuf, do hereby declare the nature of my said Invention, and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement thereof, that is to say:—

The object of my Invention is, first, the preservation, the concretion, the hardening, and the coloring in various shades of inert animal substances (or substances of animal origin), the embalming of bodies, the treatment of skins, and the coloring of silk, wool, leather, bone, ivory, feathers, &c.; second, the destruction of insects, such as ants, fleas, bugs, &c., and the preservation of animal and vegetable life from insects, the curing of disease in vegetable life generated or produced by or from insects or animalculæ, such as öidium, potato disease, &c., the preservation of substances from destructive insects, the preservation of wood and of ships, the purification of all crowded habitations and places, such as hospitals, schools, barracks, &c. I employ for the above purposes vegetable and mineral oils containing saponifiable acid oils capable of forming soluble salts in water, and of acids derived by substitution obtained from saponifiable acids contained in essential, vegetable, or mineral oils.

And my Invention includes the purification of vegetable and mineral essential oils containing saponifiable oils, without distillation, by separation.

Having thus set forth my Invention in general terms, I now proceed to describe the same more fully.

The distillation of mineral or vegetable substances containing essential oils, which again contain saponifiable acid oils, such as wood, peat, &c. amongst vegetable and coal, different kinds of schist, anthracite, &c. amongst mineral substances, produces, according to the mode of the distillation and the species of apparatus employed, a great number of products, such as acetic acid, alcohol, paraffine, coke, naphtha, &c., which are always accompanied by essential oils, or by tars containing such oils, which they yield up when properly distilled.

These essential oils, whether obtained by direct distillation of the natural substance or by special subsequent distillation of the tar product, are first obtained in complex mixtures, and are the amalgam of a large number of compounds of carbon and hydrogen, many of which appear to be acid; but whatever be the nature of the products of the distillation of the various mineral or vegetable substances, most of the essential oils, which they yield contain in a larger or smaller quantity acid and saponifiable oils, which, whether in the form of salts, natural acids, or otherwise, possess the most remarkable properties. These substances have hitherto been but imperfectly examined as simple acids, or as acids derived by substitution, and have been entirely disregarded as salts possessing such properties. The careful study which I have made of these substances in this respect will open a new and extensive field to science, and will render immense service to medicine.

Preservation of Inert Animal Substances, Embalming of Bodies, Destruction of Living Animal Substances, Preservation of Woods and Ships, Liming of Seed Grain, all by Means of Essential Oils, Vegetable or Mineral, whether in the State of Ordinary Essential Oils, Neutral or Acid, or in the State of Alkaline Salts.

General Considerations on Essential Oils, Vegetable and Mineral, especially on those of Coal, Peat, Wood, and Schist.

When any vegetable or mineral substances (especially those just mentioned) are distilled, a mixed mass of essential oils is obtained, either directly from this distillation, or subsequently by distillation of some tarry product in which they are contained. This mixture is composed of carburets of hydroden of different densities, of which some are neutral, others acid, and capable, in combination with caustic alkali, of forming various salts. All these essential oils, neutral or acid, and whether in their natural condition or in the condition of alkaline salts, have not only the property of preserving or destroying all

animal substances but also that of imparting this same property to water, in which they partially dissolve, giving a solution which may be employed for the preservation or destruction of animal substances, when an agent of great strength is not required. These essential oils, however, cannot be used indifferently, but must be applied to the purposes indicated, each according to its own peculiar properties. Thus, the acid and saponifiable oils contained in all the oils of coal, peat, wood, and schist, oils having generally a density of 6 to 8 degrees (Beaume), *i. e.*, 8 degrees denser than water, appear usually poisonous and highly corrosive, and must not therefore be employed for the preservation of substances intended for food, but may be very properly applied to the destruction of insects, miasmas, &c. The neutral oils, on the contrary, (which are lighter than water, and already known under the name of benzine, &c.,) are of the opposite character.

The raw essential oils obtained directly by single distillation, when composed of neutral and acid essential oils, can be readily separated by treating them, either cold or at a moderate heat, with concentrated caustic alkali, as will be hereafter explained.

Having made these general observations on the essential oils of coal, peat, wood, and schist, I will now point out the means of preserving or destroying animal substances. For this purpose four processes may be adopted :—First, immersion ; second, fumigation or spontaneous evaporation ; third, dissolution of the essential oil in water ; fourth, division of the oils by means of inert bodies.

First, to obtain a good result from the immersion of the substance to be treated, it should be allowed to soak in the essential oil at least for an hour, after this it should be exposed to the air. After four or five days, when the operator observes that the substance is becoming hard on the surface, and has lost the smell of the essential oil in which it was immersed, the substance may receive a coating of salad or other such oil in which has been previously dissolved some more solid grease, or a coating of simple gelatine. In the fixed oil a little essential oil of a suitable kind may be put for the purpose of keeping away the flies. In this way animal substances, nutritive or other, may be very well preserved.

Second, the process by spontaneous evaporation or by fumigation, which I am inclined to regard as the best, consists in placing the animal substances to be treated in a closed chamber, having a temperature of from 35 to 40 degrees Centigrade, which is maintained for about six hours, in order to drive off the moisture from the animal substances. This moisture must be allowed to escape through an aperture made in the upper part of the chamber. When this time has elapsed the aperture alluded to is closed, and a

temperature is maintained sufficient to evaporate the essential oil with which it is desired to impregnate the substances. The oils used should be of very small density (such as benzine, which may be chosen if the oils of coal are employed), and placed in a broad flat vessel, like a plate, within the chamber in which the animal substances are suspended. Heat may be applied beneath this vessel, if the temperature requires elevating. Thus the vapour of the essential oil is kept in contact with the meat during a longer or a shorter time, according to the quantity treated, but during at least two hours in every case; afterwards the substances are exposed to the air and painted or coated, as in the first method. Anatomical specimens may be prepared by placing at the bottom of a decanter or other such vessel about $\frac{2}{5}$ of an inch deep of benzine, suspending the specimen above the benzine in the decanter and closing the mouth hermetically. The fumigating process is conducted as before in a chamber which is kept at a temperature sufficient to prevent the condensation of the vapour. Into this chamber is introduced a supply of vapour of some essential oil, with which may be mixed any harmless aromatic essence to give any required flavour to the meat; this vapour will penetrate the substance to be preserved if the proper temperature is maintained. For this process a space of twelve hours should be allowed, after which the substance should be exposed to the air and coated with the solution or with gelatine as before, which will give a fine appearance to the preserved substances.

Third, to obtain an aqueous solution of essential oil either of phénic acid, creosote, or oils formed of these, it is sufficient to add one per cent. of the oil to any quantity of water and agitate the mixture for about ten minutes. This solution, which I have obtained very well with the oils of coal, wood, peat, and schist (the only ones I have tried), preserves meat very well, provided that it be renewed once or twice, and that the meat be allowed to soak in it at least twelve hours. If, however, it is desired to preserve substances of considerable bulk, the solution must be renewed two or three times, or a stratum of the oil must be left on the surface of the water, in order by agitation to renew in the water the essential oil taken up by the animal substance, for the water appears to me to dissolve but a very minute quantity of essential oil. These aqueous solutions will be of great utility in many cases. The aqueous solution of commercial phénic acid, for instance, may be employed with advantage in the purification of the air of crowded apartments, as the free phénic acid which it contains volatilises and is sublimated in the same time as the water. This solution too may, in a great variety of cases be substituted for the solutions of acetate of lead, of tannin, of alum, &c. On the other hand, aqueous solutions of essential oils, when freed from acid oils,

may be employed to cure all those diseases of trees, shrubs, and vegetables generally which are occasioned by animalculae or insects, the solutions of acid oils being likely to injure the vegetable by its too great energy.

Fourth. In the fourth process the essential oils, neutral or acid, vegetable or mineral, are divided by means of inert bodies, such as sand, earth, sawdust, lees, hemp, rags, &c. These substances are mixed with the proper essential oil to the proper degree of saturation. If the substances to be preserved are numerous, they may be placed together in a suitable receptacle and sprinkled with the essential oils, divided as above, and each layer of the substances to be preserved should be covered with a thin layer of the preserving material. When the entire body of any animal is to be preserved, the intestines must be removed and preserved separately. The cavity whence they are removed should then be filled with a quantity of hemp or rags impregnated with essential oil, and the entire body should be covered with properly prepared sand or sawdust. This process should be several times repeated with fresh mixture, in order to remove moisture from the animal substances, because this moisture is often the cause of decomposition.

This mode of dividing the essential oils may be made very useful for many purposes, such, for instance, as removing the caterpillars from gardens without watering the soil either with essential oils or with alkaline solution of saponifiable oils, a process likely to injure the tender parts of the plants. Another use to which this material may be applied is to keep flies from annoying domestic animals, either by sprinkling with it the place where the animal stands or the back of the animal itself. Again, if after sowing or planting any vegetables the ground be sprinkled with sawdust, earth, or sand impregnated with the heavier oils, neither birds nor insects will venture to carry off or destroy the seed or plants. Solid carburet of hydrogen which is produced by the oils of coals (naphthaline) would give the same results as the essential oils. By putting at the bottom of the hold of a ship, either as ballast or amongst ballast of other kinds, a sufficient quantity of sand, earth, or sawdust impregnated with the raw oils of coals (as being the cheapest of the essential oils), the destruction of the material of the ship by insects would be prevented. This general method of preserving animal substances is superior to the use of salt, and is certain to produce the effect desired. These processes, or others analogous to them, are to be adopted for the preservation or destruction of animal substances by means of essential oils, vegetable or mineral. Results nearly identical can be obtained by means of the alkaline salts produced by the acid essential oils which are contained in the essential oils of coal, of peat, of wood, and of schist.

Bobœuf's Impts. in Preserving, &c. Animal and Vegetable Substances, &c.

Preservation and Destruction of Animal Substances and Embalming of Bodies by means of Alkaline Salts, produced by the Acid and Saponifiable Oils which are Extracted from the Essential Oils, Animal and Mineral.

Preparation of the Alkaline Salts (Phénates) and of Commercial Phénic Acid.

To obtain an alkaline salt adapted for the preservation of animal substances the mixed mass of essential oils obtained from the distillation of one of the substances alluded to above must be agitated for half an hour with some caustic alkali. In this operation the essential oils must be worked cold, if it is desired not to lose any of the volatile products which they contain. If this object be not desired a slight heat may be used to facilitate the process. The caustic alkali which I should recommend is caustic soda, because it is the cheapest; but in any case the caustic alkali must be highly concentrated, in the case of soda 36 degrees. The proportion of the caustic alkali to be used may vary from $\frac{1}{3}$rd to $\frac{1}{5}$th of the weight of essential oil to be treated. The quantity of phénic acid contained in the mixed oils may be tested by treating a small quantity in a graduated test tube with caustic soda. The quantity of phénic acid will be proportionate to the amount of the mixture which is transformed into phénate of soda. Caustic lime also may be used, but although this substance seems cheaper than either soda or potassa, yet it will be seen that the products obtained by its use are less pure, because of the non-saponifiable oils which accompany it, and because of the necessity for a strong heat to effect the required chemical combination, which heat valatilises a great part of the light essential oils often of great value. This alkali then should not be used except when great purity of the products is not an object, and the light oils volatilised are of insignificant value, or when an insoluble alkaline phénate only is required. The essential oils being well mixed with the alkali, as already stated, water equal in weight to the alkali employed is added, and the whole agitated for the space of ten minutes. It is then left to settle for 24 hours, when the lower part which contains the salt of soda already formed may be drawn off by means of a pump until the liquor begins to become troubled. The clear part of the liquid is put into a separate vessel, and the milky or troubled part is put into another vessel to settle. The transparent liquor contains no salt of soda, but consists of uncombined essential oils. This last liquid may be added with the water to the mixed oils and alkali in the next operation, or if no subsequent operation is to be performed, it may be filtered and added to the salt of soda already obtained. As this salt of soda thus obtained appears to be formed by the saponification of a

mixture of various acid oils, which appear to me more analagous to phénic acid and to creosote than to any other substance, I shall for the future designate these saponifiable acid oils "commercial phénic acid," and their combinations with the alkali I shall call "phénates." After having collected all the phénate of soda thus formed, the operator decomposes it by pouring on it gradually any vegetable or mineral acid (as sulphuric acid, for example), until there is an effervescence produced by the liberation of carbonic acid. This carbonic acid enters the composition with the caustic alkali, which nearly always contains a quantity of it; and it is not displaced by the phénic acid, but is driven off by the more powerful sulphuric acid. When this decomposition is complete the mixture will form itself into two separate and distinct strata, the upper one being commercial phénic acid, whieh may be removed; the lower one is sulphate of soda, and may be re-sold; thus, from this process may be obtained, as required, two distinct products, commercial phénic acid and phénate of soda. When, as for my present purpose, the alkaline salts obtained from the above process are alone required, the decomposition of the alkaline phénate is unnecessary. This phénate is taken and boiled and so concentrated until it is no longer odorous, for although the greater part of empyreumatical substances are generally not saponifiable, yet a certain quantity of such oils are always present in the phénate or phénic acid obtained as above. As these substances are not in a state of combination with the composition, and as they are volatile, they are driven off by by boiling. I shall shew presently the method of separating these substances from the commercial phénic acid.

Before proceeding further I would remark the importance of one of the steps in the above process for producing the phénate of soda and phénic acid. After the agitation of the mixture of essential oils and caustic alkali, I add a quantity of water equal in weight to the alkali in the mixture. This step is the more necessary because the phénates, however limpid they may be when greatly concentrated, become less so when their degree of concentration is lowered to 8 or 10 degrees Beaumé, and because a saponified oil is re-formed by the addition of water, and takes up its position of repose upon the surface. If, therefore, the degree of concentration of the alkaline phénate be suddenly reduced to 10 degrees, it will happen that a part of the saponified essential oils being re-formed or again liberated, it ascends and mixes again with the neutral oils, which are much lighter than the saponifiable oils, so that these neutral oils are thus increased in density, and at the same time made impure.

As phénates to be used in preserving or destroying animal substances

are not required highly concentrated (those of from 1 to 4 degrees being sufficiently strong), the phénate of soda, as above manufactured, should be placed in a vessel of three or four times its own volume, and water should be added till the phénate is reduced to 10 degrees Beaumé. During this reduction a part of the phénate will be decomposed, and the freed commercial phénic acid will ascend and float at the surface. The reduced phénate may be then decanted off, and the re-formed phénic acid may be collected and may afterwards be used to form an acid "derived by substitution," and may then be employed for coloring or rendering impervious any animal substances. This phénate may be applied to the preservation or destruction of animal substances by immersing the said substances in it, taking care to increase or to maintain the strength of the solution according to the size of the substances treated. After this treatment the said animal substances must be exposed to dry in the air.

The essential oils which yield the greatest quantity of commercial phénic acid, and consequently the greatest quantity of phénate, are, first, the essential oils of coal; second, those of peat; third, those of wood; fourth, those of schist.

Embalming of Bodies.

To preserve a dead body entire without employing the usual agents, it is necessary to immerse the whole corpse for from 24 to 48 hours in a solution of alkaline phénate of from 6 to 10 degrees; afterwards the body must be dried in the air. If it is thought desirable to use the method of injection by the carotide, phénate of soda of a density of from 10 to 15 degrees should be used. Phénic acid may in this case be used instead of the phénate. To produce the same result by means of the method of division by sand or other such material, these materials should be saturated with phénic acid in preference to the neutral oils.

Application of the Saponifiable Acid Oils contained in Vegetable or Mineral Essential Oils transformed by substitution to Hardening, Coloring, and Rendering Impervious all Kinds of Animal Substances.

Leather is variously prepared according to the use to which it is to be put; that sort which is required to possess rather suppleness than hardness or imperviousness is curried, *i.e.*, treated with alum, &c.; that kind, on the other hand, which is required to be hard and impervious undergoes long and repeated immersions in solutions of crushed tan, solutions therefore containing a quantity of more or less concentrated tannic acid. The preparation

and dressing of leather is done by two principal methods:—1st, by means of alum; 2nd, by means of tannic acid. The solution of alum acts by entering the pores of the leather, and depositing and leaving in those pores a quantity of insoluble subsulphate of aluminum. The tannic acid acts in a different manner by chemically combining with the gelatine of which the skins are mainly composed, and thus forming an insoluble body which is impervious to water. Nearly the same result as is produced by the process of currying may be obtained by soaking the skins in a solution of phénate of soda only, or after having thus soaked them by immersing them in a solution of some salt whose base is capable of combining with the phénic acid to form an insoluble body. Simple lime water may be employed for this purpose. But to obtain the result produced by the tannic acid on the gelatine of the skins, it is necessary that the commercial phénic acid should undergo a transformation by substitution. This transformation proves in the most satisfactory manner that these saponifiable acid oils contained by the essential oils (especially those of coal and peat) are closely analogous with pure phénic acid.

Transformation of the Saponifiable Acid Oils into Tri-nitro-phénic Acids.

Pure phénic acid is a colorless crystalline body, which is obtained from various substances (such as salycilique acids, benzoin, &c.) Its chemical formula is $C^{12}H^5O+HO$. Neither this acid nor its salts precipitates gelatine, but if nitric acid be made to react on the phénic acid, this latter passes first into the state of bi-nitro-phénic acid. The formula of this acid is $C^{12}H^2N^3O+HO$. As this formula shews, three particles of hydrogen have been removed from the phénic acid and three particles of nitrogen have taken their place, there have happened then during the complicated chemical action the separation of three particles of hydrogen and a substitution of three particles of nitrogen in their place; the tri-nitro-phénic acid is therefore an acid derived by substitution. The saponifiable acid oil contained by the essential oils of vegetable and mineral substances behave exactly in the same manner, and form acids exactly analogous to the tri-nitro-phénic acid, and which, like the tri-nitro-phénic acid, precipitate gelatine. This property belonging to these essential oils and their derivatives has never before been discovered. The following is the method of proceeding to obtain this result:—Take the acid oils obtained from the decomposition of the phénate of soda at 8 or 10 degrees of concentration. (These acid oils are, as herein-before explained, obtained by adding an equivalent of water to the mixed phénate of soda when it is required to reduce its concentration.) These oils are treated with nitric

acid as follows:—Take 8 parts of nitric acid to 1 of commercial phénic acid to be treated; divide the nitric acid into two portions, one being a quarter and the other three-quarters of the whole; then place the phénic acid in a vessel of glass or of stone whose capacity is 15 or 20 times the volume of the phénic acid; now pour gradually (for the reaction is violent) some nitric acid from the vessel containing the larger quantity of that fluid, and continue this till the whole of this portion of the acid is used. When this is done, and when the reaction has ceased, the vessel must be put on a slow fire (if the material of the vessel will permit), or in a warm bath of oil or fat (if the vessel be of stone), and after the reaction has recommenced, by reason of the heat, the other portion of the nitric acid is added to the mixture. When this is done the heating is continued, and evaporation goes on until there is no more hypo-nitric acid formed, and until the mixture begins to adhere to the wooden spatula with which it is stirred, the whole is then withdrawn from the fire or bath and allowed to cool. The mixture is then filtered to disengage the nitric acid from it. When this operation is complete the tri-nitro-phénic acid obtained from it should be crystallised and nearly pure.

If, instead of commercial phénic acid obtained from phénate diluted with water three times the weight of the caustic alkali used, phénic acid obtained from phénate of soda of 15 to 20 degrees be employed, then, in order to obtain a product of a superior kind, the following course must be adopted:—The phénic acid is re-dissolved in caustic alkali to re-form a phénate of soda, which is then diluted by the addition of water three times the weight of the alkali employed, thus reducing it to 8 or 10 degrees. By this dilution of the phénate a chemical action is set up, but instead of an oil being separated in the action a solid of disagreeable smell is precipitated. The new phénate is then filtered and decomposed by means of an acid. By this re-formation a good product is obtained. This precaution is needed, because, when it is attempted to transform phénic acids obtained from very concentrated phénate of soda into tri-nitro-phénic acid, the tri-nitro-phénic acid so obtained is imperfectly crystallised, and contains a viscous matter not readily attacked by nitric acid. In this state tri-nitro-phénic acid precipitates gelatine, and acts upon skins like tannic acid; but the precipitate thus formed, though insoluble in cold water, is soluble in warm water. To obtain an agent which will form with gelatine a precipitate as insoluble as that given by tannic acid, alum in greater or less quantity must be mixed with the tri-nitro-phénic acid. By the following method may be obtained a composition perfectly homogeneous, capable of forming with gelatine a precipitate insoluble either in cold or hot water, capable, that is, of producing in all respects the same effects upon the skins of animals

as are ordinarily produced by the use of tan :—Take three parts of alum and one of tri-nitro-phénic acid, dissolve the alum in its water of crystallisation, adding, however, a little more water. When the alum is perfectly dissolved add the tri-nitro-phénic acid, let it dissolve, and stir the whole in order to mix it thoroughly ; then take a quantity of flour equal in weight to one-third of the acid employed, and add it to the mixture ; now let it simmer over the fire till it acquires the consistence of clear starch, and then remove it from the fire and keep it stirred till it is cold. The flour is used to produce an intimate union between two substances of different densities, whose amalgamation without the aid of the flour would be very imperfect ; it holds them together by seizing them all. When tri-nitro-phénic acid is to be substituted for tannic acid in the concretion of the skins of animals, and in rendering them impervious to moisture, one part of tri-nitro-phénic acid mixed with alum is dissolved in 50 parts of water, and this solution may be employed just as the solution of tannic acid is commonly employed. It is hardly necessary to add that solutions more or less strong may and ought to be used, according as the operation is required to be more or less rapid ; indeed, solutions containing twice the above proportion of acid, or even stronger, may be employed, according to circumstances. This new tanning material, hitherto unknown, has over tan the immense advantage that it can be carried from place to place in a concentrated state, and being kept in this state it does not deteriorate, and it may be obtained in all countries. Very satisfactory results may be obtained by the partial use of this mixture of alum and tri-nitro-phénic acid with solutions of tan itself ; and this is also true of the phénates, which may be also added with advantage to solutions of tan or tannic acid. Again, special kinds of leather may be prepared by means of phénic acid only, which, being soluble in most of the various essential and fixed oils, may be mixed with them and diluted to any required extent.

Coloring Animal Substances or Substances of Animal Origin, such as Leather, Wools, Silk, Bone, Ivory, Feathers, &c., by means of Acids derived by substitution from the Saponifiable Oils contained in Vegetable and Mineral Essential Oils.

The acids derived by substitution from the saponifiable acid oils contained in the vegetable and mineral essential oils possess great coloring power, and produce colors of striking beauty. Their solutions are generally of a bright yellow in the state of acids, and of a deep yellow in the state of salts, when the derived acid is soluble in water ; but when the derived acids are insoluble or imperfectly soluble in water, but soluble in alkalies, the colors then obtained

from their various solutions are brown and red. When it is desired to stain animal substances, or substances of animal origin, it is necessary to dissolve the coloring matter of the derived acids (which, for abbreviation, I shall call tri-nitro-phénic acids) in warm water, in the proportion of one part of acid to 1000 parts of warm water; boil the whole for 10 minutes, and then let it stand, in order that oils which may be lodged amongst the crystals may settle to the bottom; filter and then decant. Boil the solution, and plunge into it the objects to be colored, and afterwards rinse them in pure water. When the tri-nitro-phénic acid combined with alum in the manner herein-before described is employed, then 5 parts of acid must be added to the 1000 parts of water. This combination of tri-nitro-phénic acid and alum has the following important advantages as a coloring agent over the acid alone:—1st, it can be used immediately after its dissolution without injury to the substances operated on, which is not the case with ordinary tri-nitro-phénic acid; 2nd, because the alum combines with nearly all tissues, and its combination produces purer and more lasting colors; 3rd, it is much more easily and comfortably manipulated, and much more cleanly. This application of the yellow solutions of tri-nitro-phénic acid is not entirely new, and I do not claim it as my Invention, for this substance has been for several years employed as a coloring agent. I claim, however, the mode of preparing this coloring matter which I have described, a method which is greatly superior to those hitherto known; and the coloring matter, as already stated, possesses the great advantage of being applicable immediately after it is dissolved without injury to the animal substances colored.

When the acid derived by substitution is but little or not at all soluble in water, it must then be treated with some caustic alkali to form a salt soluble in water, and which in these circumstances ordinarily gives solutions of a yellowish brown color. These solutions are very good coloring agents. It is necessary in all cases to take care to rinse the substances operated on in water slightly acidulated, in order to fix the color. With reference to the red coloring matter which may also be obtained, I have not yet succeeded in producing it economically enough to speak further of it at present.

The mode of preparing tri-nitro-phénic acid, as heretofore conducted, consists in taking ordinary oil of coal, or the same oil distilled, and treating it with eight times its weight of nitric acid; but from this process is obtained merely a viscous mass containing at most not more than 33 per cent. of real tri-nitro-phénic acid, while the process I have described gives a result containing nearly 90 per cent. of the acid. With regard to these properties but one particular fact has hitherto been discovered and pointed out, viz., that the

oils of coal (amongst the cheap essential oils of commerce) produce a yellow color under the action of nitric acid, and this coloring matter has been employed because cheaper than those derived from other sources; and with this former investigators were satisfied, while I, on the contrary, propound a general principle, viz., that not only the essential oils of coal, but all essential oils which contain saponifiable acid oils yield yellow and other coloring matters. For the oils of peat, wood, schist, hitherto unexamined in this respect, I have given the manner of treatment which produces from them coloring matters of a similar nature; and I have detailed the method for obtaining from these oils in an economical manner the tri-nitro-phénic acid, and in this method the nitric acid is used as a reagent only with those oils which are capable of yielding the required acid, and the reagent is not wasted on substances incapable of yielding it. Tri-nitro-phenic acid may be used cold as a coloring agent. With carmine and indigo it produces good greens.

Treatment of Noxious and Destructive Insects, Preservation of Woods and Ships, Purification of the Air of Hospitals, &c. and of all Places of Crowded Assembly.

Various salts bave been employed to preserve woods from destructive insects. One general method of effecting this consists in immersing the wood in various solutions of salts, and forcing the solution into the interstices of the wood. Another method consists of immersing the wood in the heavier oils of coal. For these various solutions hitherto employed, solution of phénate of soda of 5 or 6 degrees may be substituted. This solution, while it is at least as efficacious as those previously used, has the important advantage over them of being cheaper. The use of the phénate of soda will also have over the second of the older processes the advantage of leaving in the pores of the wood a fixed salt, which will permanently protect it. To protect ships from insects it is only necessary to treat with phénate of soda all the timbers and planks employed in their construction before the said timbers or planks are put into place. By daily sprinkling hospitals, barracks, schools, &c. with solution of phénate of soda of one degree, they may be kept clear of flies, bugs, &c., and by washing bedsteads with solution of phénate of soda of 4 degrees, and forcing it into all holes and crevices which harbour bugs, those offensive creatures may be completely destroyed.

Purification of the Vegetable and Mineral Essential Oils which contain Saponifiable Oils.

The general mass of vegetable and mineral essential oils containing acid saponifiable oils is always of a much less density than the acid oils which are

extracted from them by saponification produced by means of caustic alkali. It is easy then to understand that when these denser oils are removed from the general mass, the non-saponifiable essential oils which remain will be lighter in proportion as the density of the extracted oils is greater, and their quantity more abundant. An example will make this still more clear:—The general mass of the raw oils of coal have a density of 15 degrees by the areometer of Cartier, 10 degrees being taken as the density of water. The acid oils extracted from this mass have a density of $7\frac{1}{2}$ degrees Beaumé, that is, they are $7\frac{1}{2}$ degrees heavier than water, so that between the two species of oil there is a difference of density of $12\frac{1}{2}$ degrees. After the saponification of the said acid oils, the non-saponifiable essential oils measure 19 or 20 degrees by the areometer, instead of 15 as before. This difference of density is then a necessary consequence of the treatment to which I subject the essential oils, and is an advantageous result without distillation, as it is the effect of the separation of the oils. Such is the connected series of results which I have obtained from the acid saponifiable oils contained in the vegetable and mineral essential oils, and which constitute my Invention.

And having now described the nature of my said Invention, and in what manner the same is to be performed, I declare that I claim,—

First, the improvements in preserving and otherwise treating animal and vegetable substances, herein-before described.

And, second, the treatment of vegetable and mineral essential oils, herein-before described.

In witness whereof, I, the said Pierre Alexis Francisse Bobœuf, have hereunto set my hand and seal, this Twenty-third day of January, One thousand eight hundred and fifty-eight.

P. A. F. BOBŒUF. (L.S.)

Witness,

Ch. Armengaud, J^r^, Ing^r^ Civil,

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